VISION FOR SPACE EXPLORATION

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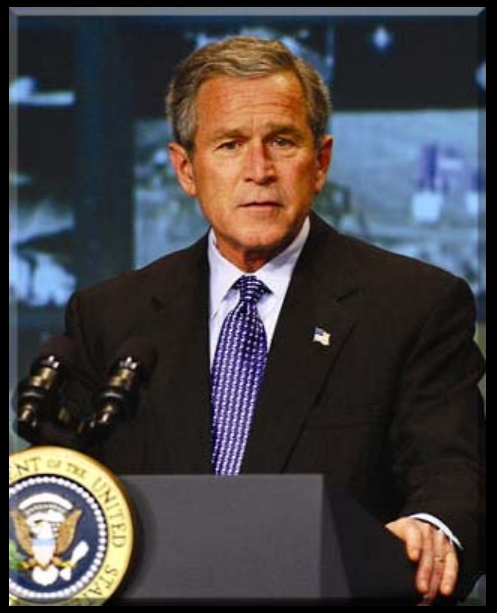
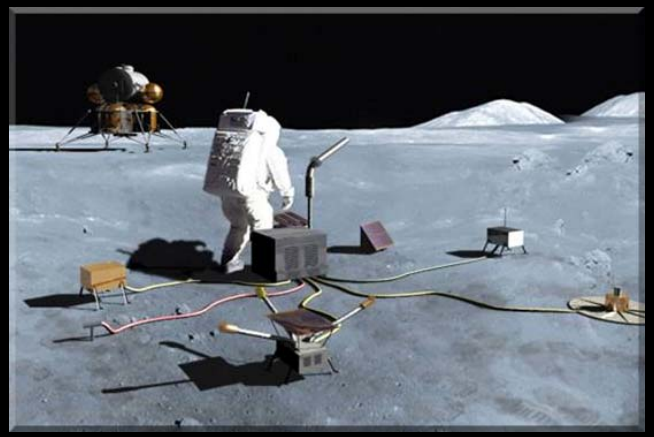
A Bold Vision for Space Exploration

- **Complete the International Space Station**
- **Safely fly the Space Shuttle until 2010**
- **Develop and fly the Crew Exploration Vehicle (by 2014)**
- **Return to the moon (by 2020)**
- **Sustained and affordable human and robotic program**
- **Develop innovative technologies, knowledge, and infrastructures**
- **Promote international and commercial participation**

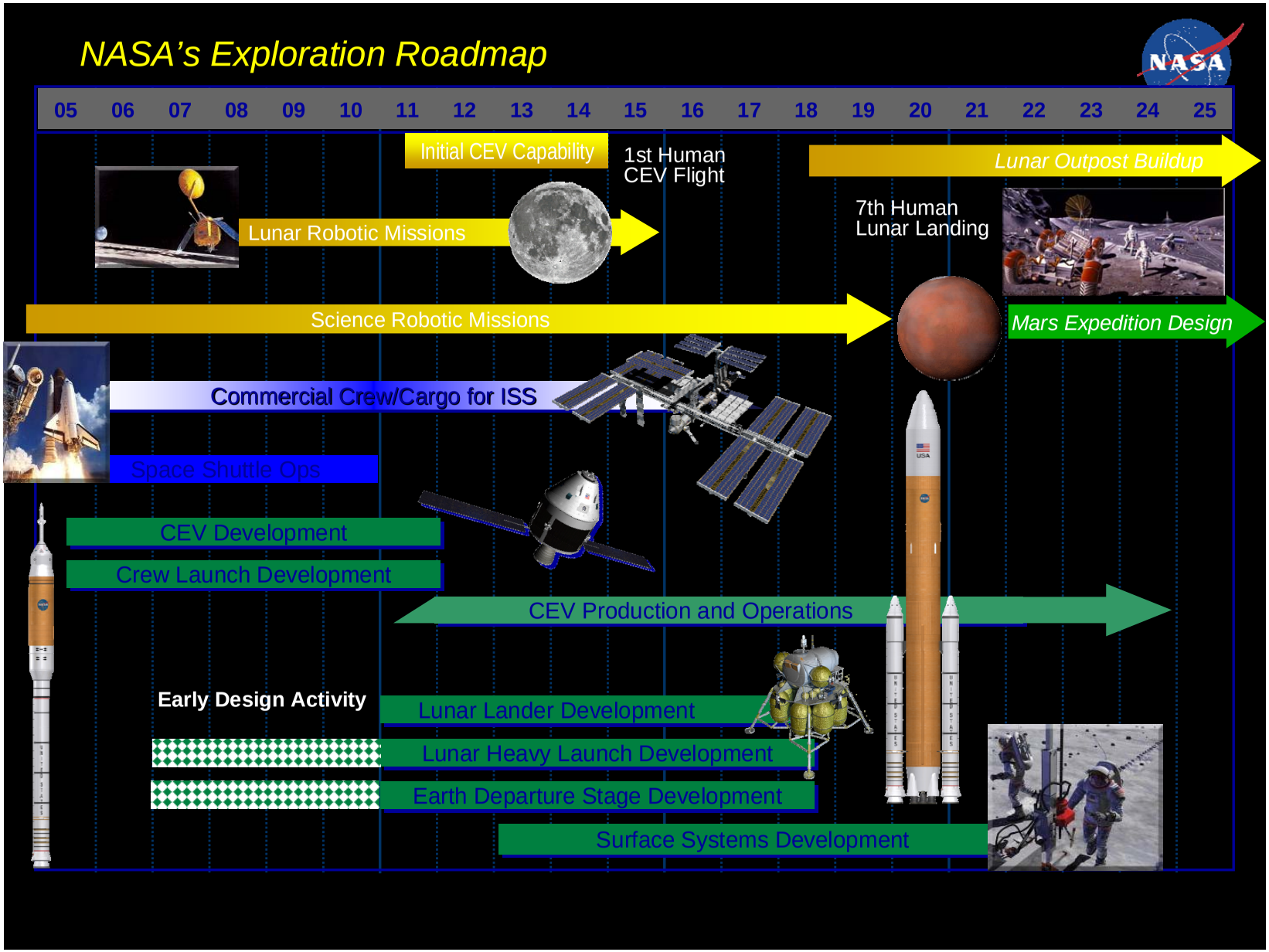


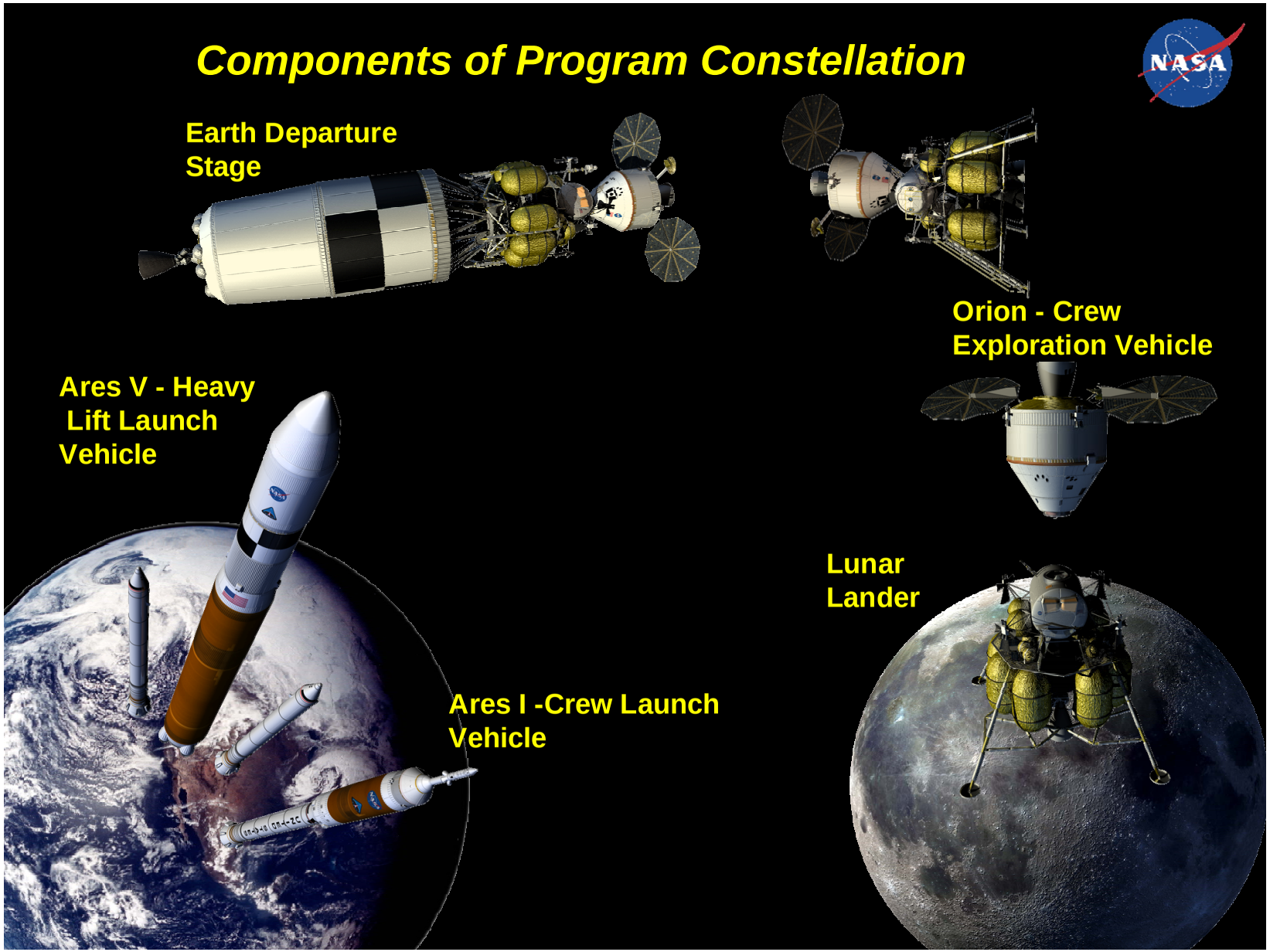


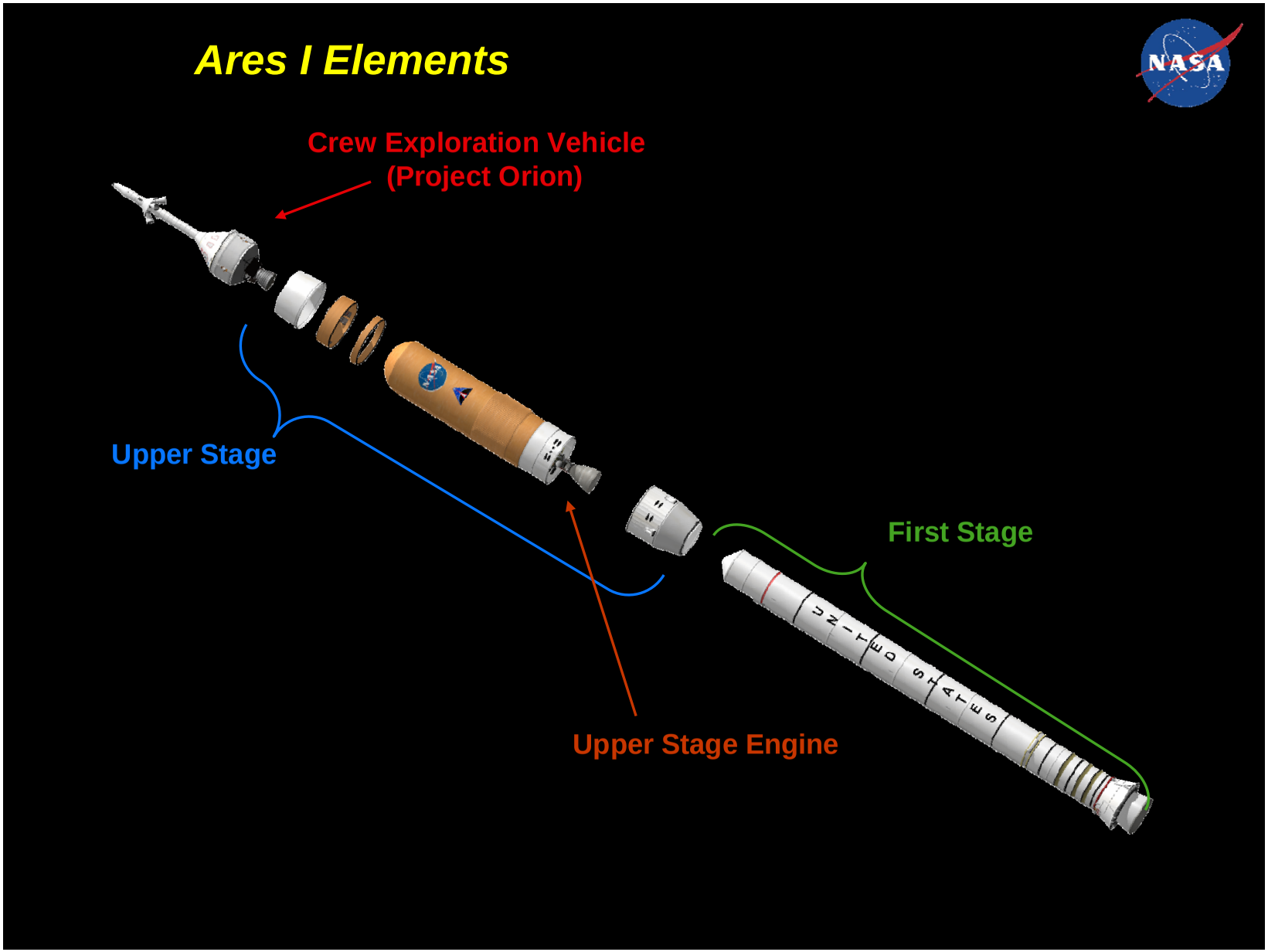
"It is time for America to take the next steps.

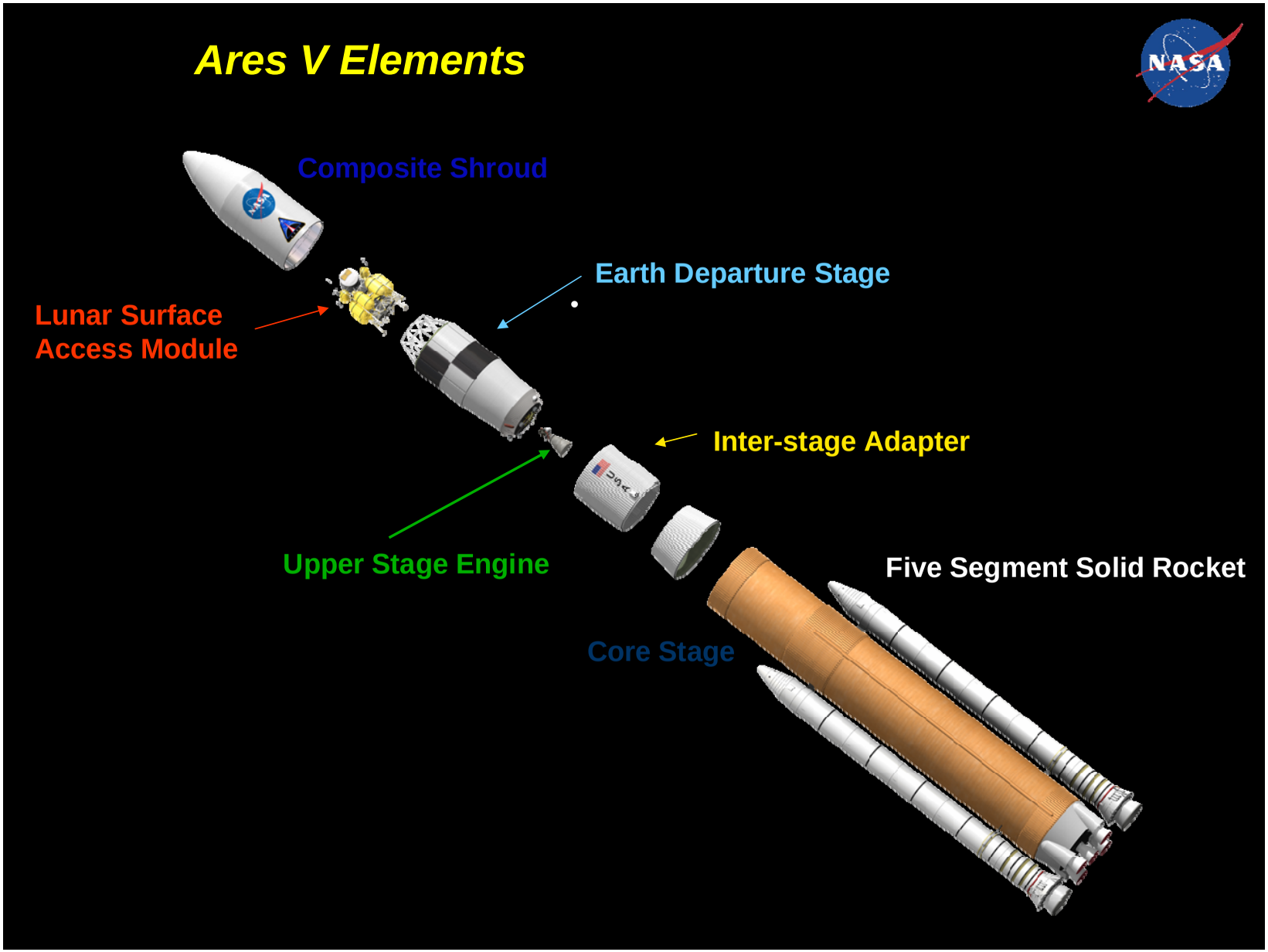
Today I announce a new plan to explore space and extend a human presence across our solar system. We will begin the effort quickly, using existing programs and personnel. We'll make steady progress – one mission, one voyage, one landing at a time."

President George W. Bush – January 14, 2004


NASA's Exploration Roadmap
NASA
05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Initial CEV Capability
1st Human CEV Flight
Lunar Outpost Buildup
7th Human Lunar Landing
Lunar Robotic Missions
Science Robotic Missions
Mars Expedition Design
Commercial Crew/Cargo for ISS
Space Shuttle Ops
CEV Development
Crew Launch Development
CEV Production and Operations
Early Design Activity
Lunar Lander Development
Lunar Heavy Launch Development
Earth Departure Stage Development
Surface Systems Development


Components of Program Constellation
NASA
Earth Departure Stage
Orion - Crew Exploration Vehicle
Ares V - Heavy Lift Launch Vehicle
Lunar Lander
Ares I -Crew Launch Vehicle


Ares I Elements
NASA
Crew Exploration Vehicle
(Project Orion)
Upper Stage
First Stage
Upper Stage Engine


Ares V Elements
NASA
Composite Shroud
Earth Departure Stage
Lunar Surface
Access Module
Inter-stage Adapter
Upper Stage Engine
Five Segment Solid Rocket
Core Stage

- Launch Vehicle Comparisons -

Space Shuttle

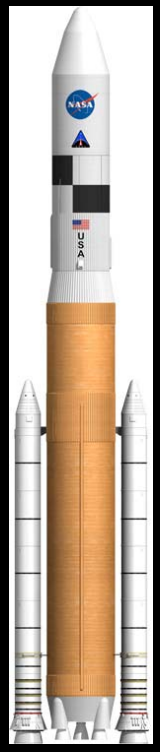
Height: 184.2 ft
Gross Liftoff Mass: 4.5M lb

55k lbm to LEO

Ares I

Height: 321 ft
Gross Liftoff Mass: 2.0M lb

48k lbm to LEO



Ares V

Height: 358 ft
Gross Liftoff Mass: 7.3M lb

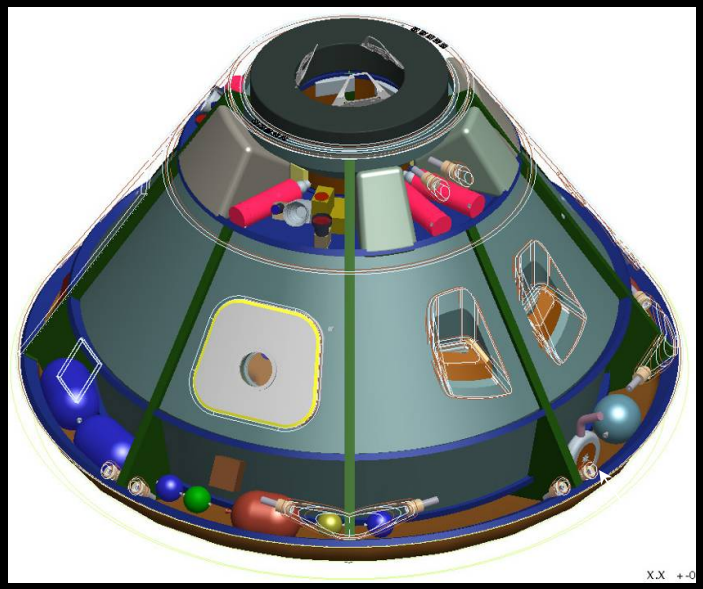
117k lbm to TLI

Saturn V

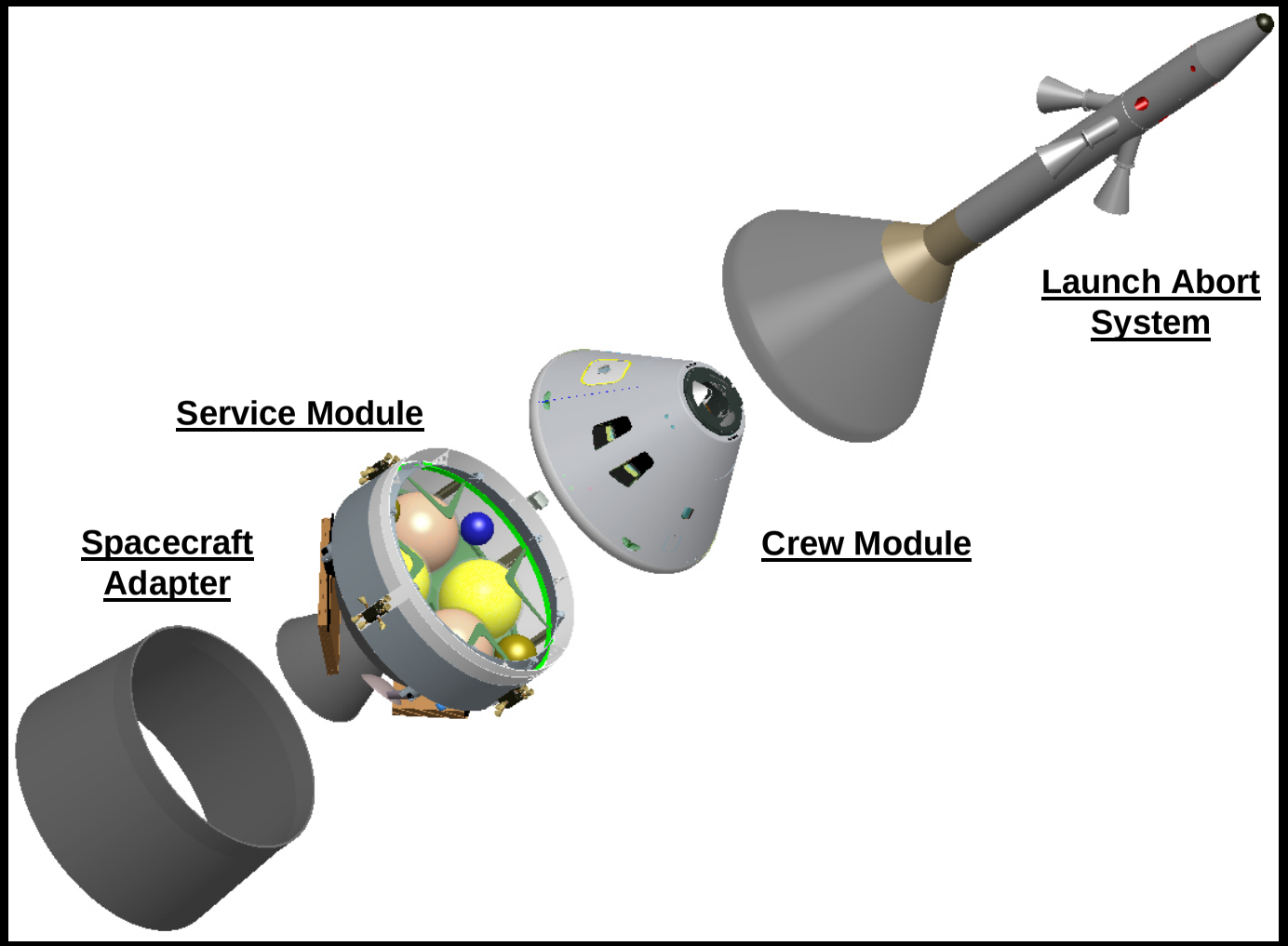
Height: 364 ft
Gross Liftoff Mass: 6.5M lb

99k lbm to TLI
262k lbm to LEO

Orion Crew Module

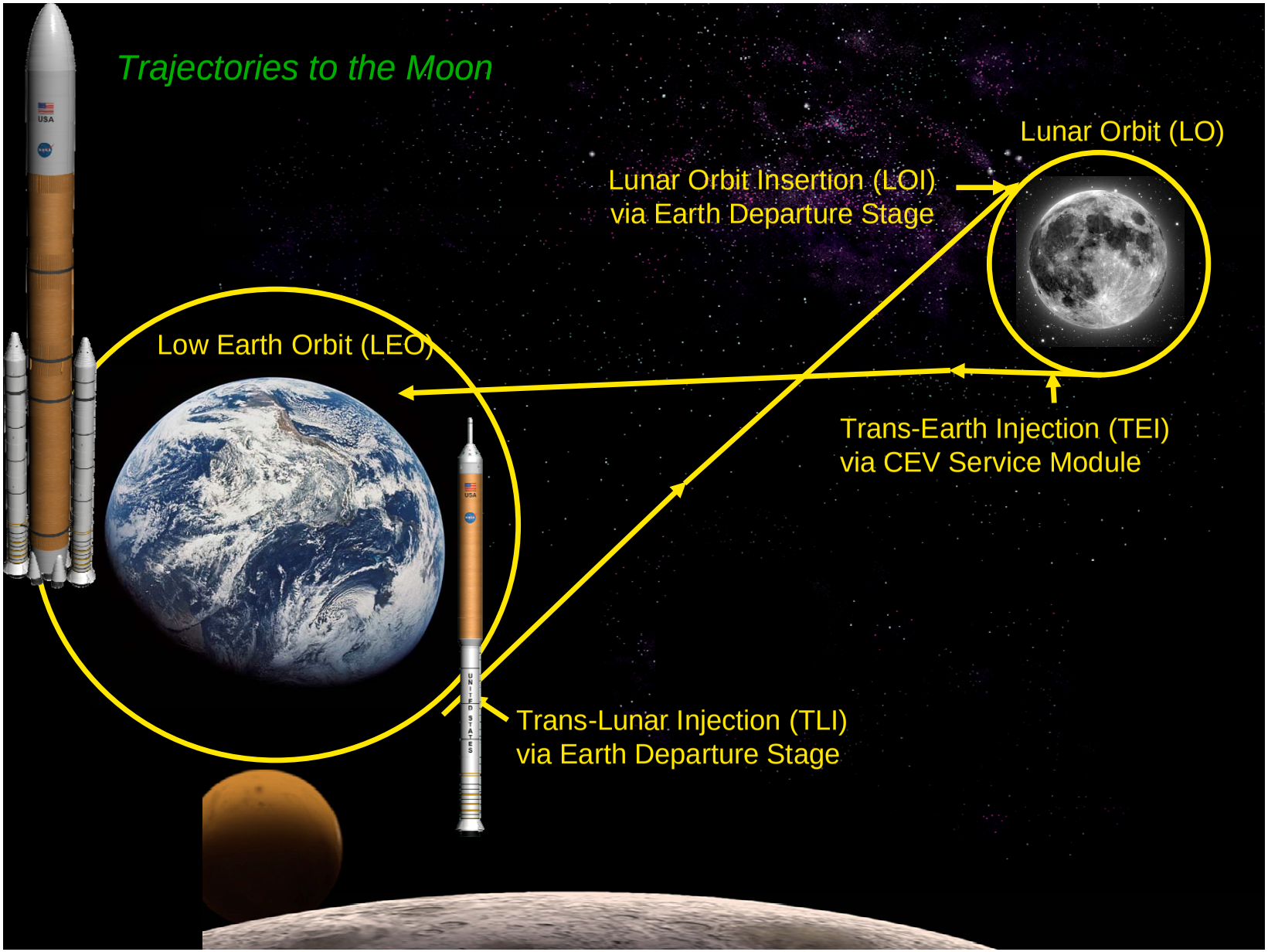


NASA Baseline Configuration



Orion will travel to the Space Station

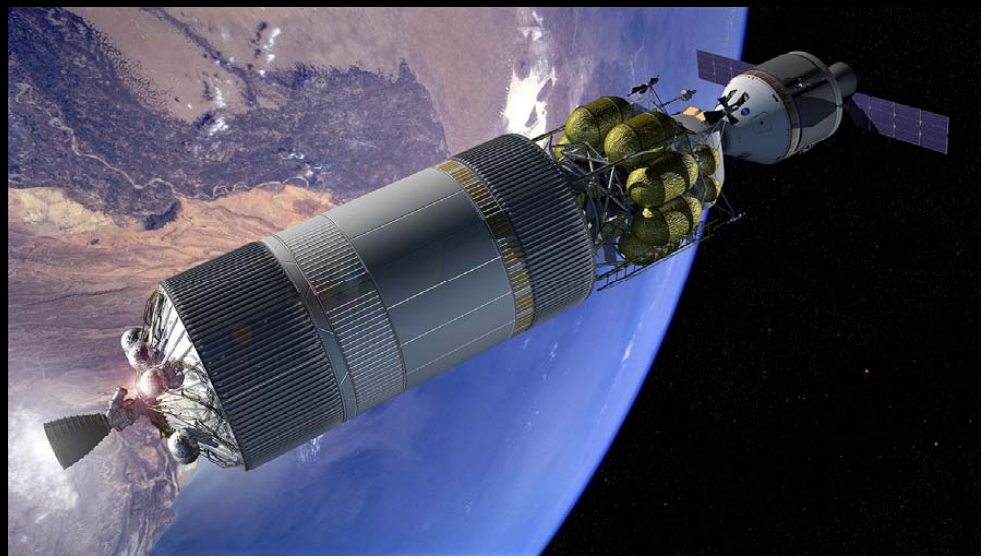
- **Transport up to 6 crew members on Orion for crew rotation**
- **210 day stay time**
- **Emergency lifeboat for entire crew**
- **Deliver supplies**


Trajectories to the Moon
Lunar Orbit (LO)
Lunar Orbit Insertion (LOI)
via Earth Departure Stage
Low Earth Orbit (LEO)
Trans-Earth Injection (TEI)
via CEV Service Module
Trans-Lunar Injection (TLI)
via Earth Departure Stage

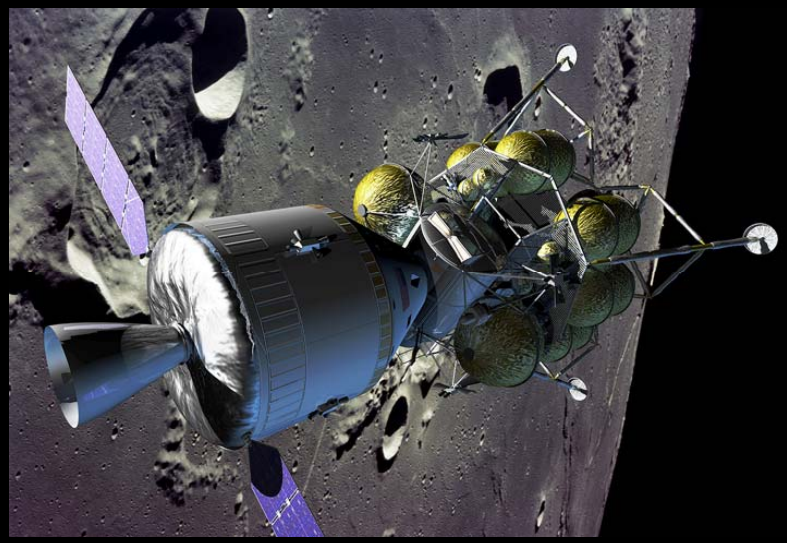
Orion Lunar Mission – Getting There

- **Orion docks with the Earth Departure Stage (EDS) in Earth Orbit**

- **Earth Departure Stage (EDS) travels to Moon with :**
  - **Lunar Surface Access Module (LSAM)**
  - **Orion: up to 4 crew**

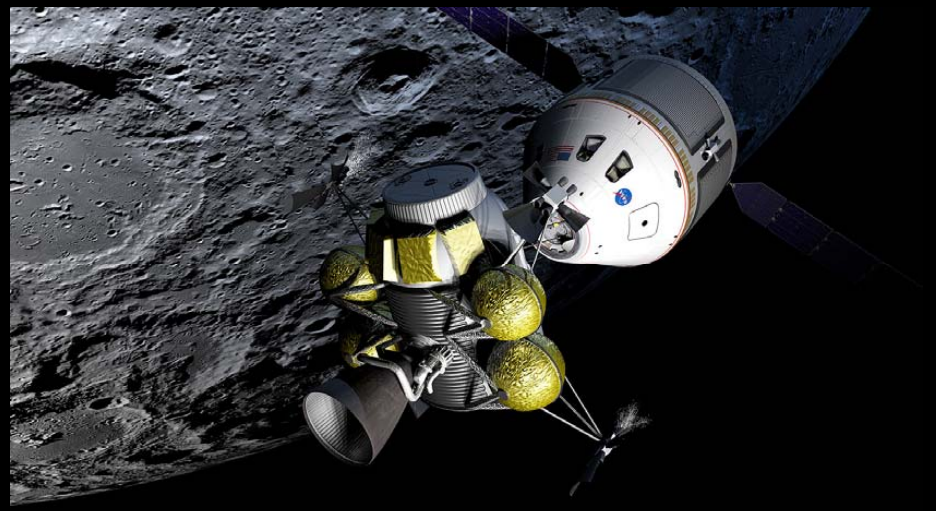


Orion Lunar Mission – Arriving There



- **Orion and Lander travel to Moon**
- **Lander descends to lunar surface for up to 7 days**

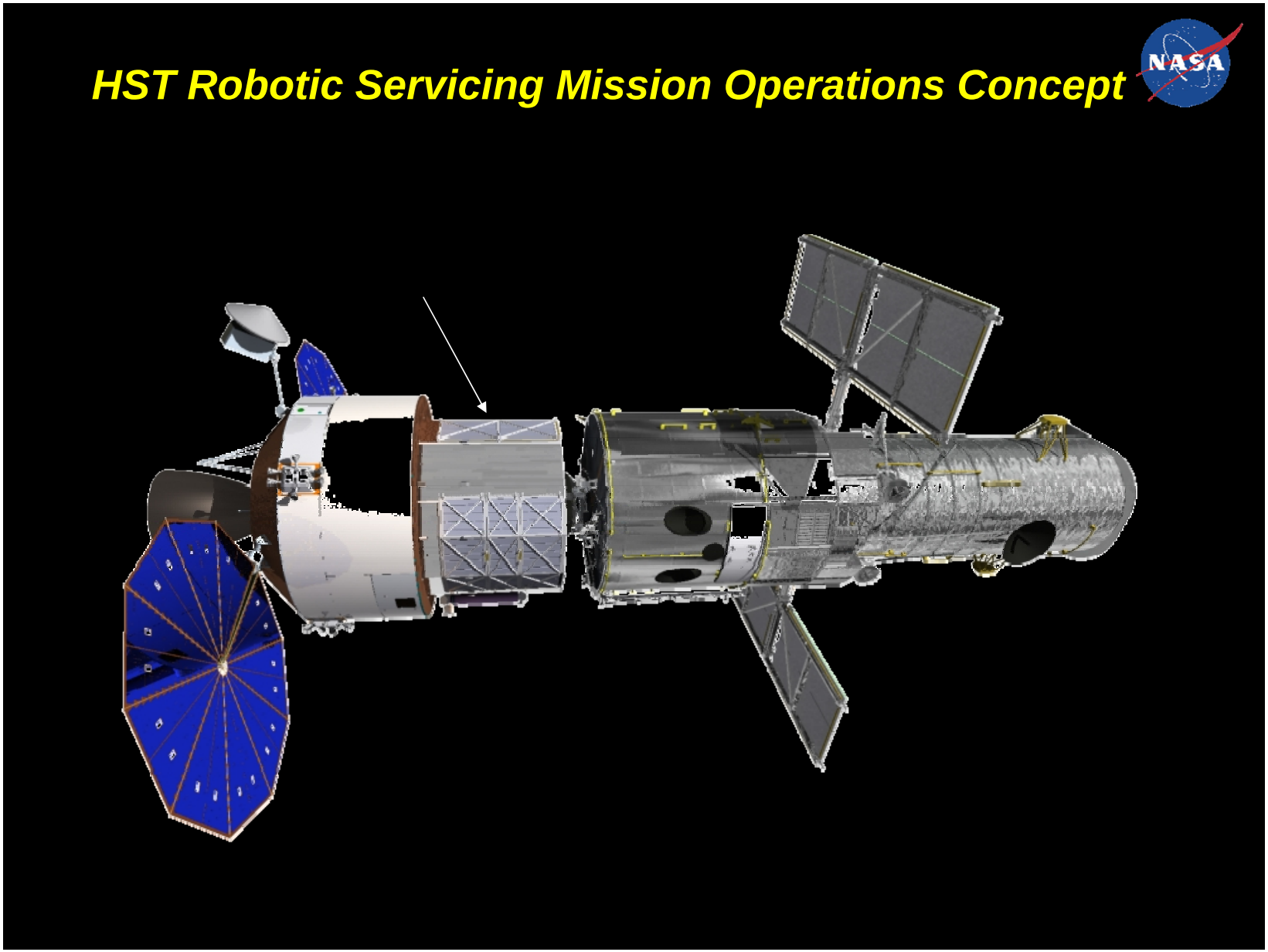
- **Lander upper stage returns to Orion in lunar orbit**



CEV Lunar Mission – Coming Home

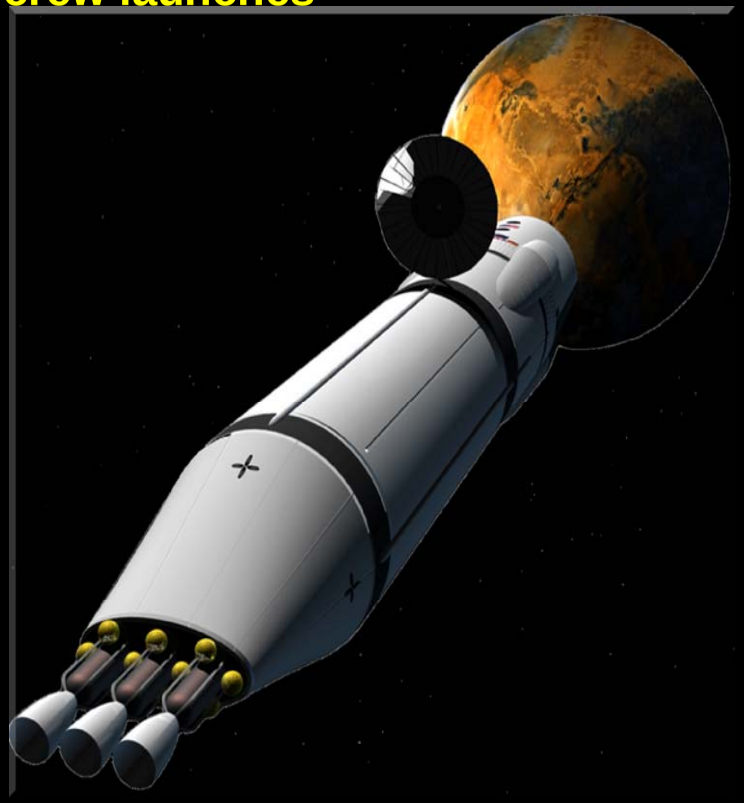
- **Orion provides Earth return trajectory**

- **Command Module capsule reenters atmosphere**
- **Parachute descent**
- **Land in water or on land**


HST Robotic Servicing Mission Operations Concept
NASA

How We Will Get to Mars

- 4 to 5 assembly flights to low Earth orbit
- Mars surface outpost before the crew launches
  - Electricity
  - Shelter
  - Supplies
- 180 day transit time to/from Mars
  - 6 crew members
- 500 days on the surface
  - Food, Oxygen and water



Glenn Research Center's Two Campuses

Cleveland (Brook Park and Fairview Park)

- 350 acres
- 1707 civil servants and 1367 contractors

Plum Brook (Sandusky)

- 6400 acres
- 9 civil servants and 87 contractors


Thank you
NASA